

**DECLARATION UNDER 37 C.F.R. § 1.132**

I, Yasuhito Inagaki, declare and state as follows:

1. I am a co-inventor of the subject matter claimed in U.S. Patent Application 09/905,662 entitled, "SUBSTRATE CLEANING METHOD AND SUBSTRATE CLEANING APPARATUS", which claims priority to Japanese Application Nos. P2000-214974, filed July 14, 2000, and P2000-240134, filed August 8, 2000.
2. I have reviewed the results of experiments, which are attached hereto, comparing the invention claimed in the above-referenced application with the apparatus disclosed in U.S. Patent No. 6,281,845 (Verheverbeke et al.) and Japanese Patent No. JP408334461A (JP'461), which were cited against pending claims 6-8, 12 and 13 of the above-referenced Application in an Office action dated December 16, 2003. The experiments performed were as follows:
  - a. A substrate cleaning apparatus in accordance with the claims of the 09/905,662 application was assembled.
  - b. A substrate cleaning method similar to that recited in the claims of the 09/905,662 application was performed. The method performed differed from the claimed method in that the assembled substrate cleaning apparatus used water and ammonium fluoride as replenishing feed fluids. The change in etching rate with time and change in concentration of etching components, namely ammonium fluoride (NH<sub>4</sub>F) and hydrofluoric acid (HF), with time were measured. The measured rates and concentrations were charted with respect to time on the graphs attached as Exhibit A.
  - c. The substrate cleaning method recited in the claims of the 09/905,662 application was performed using the assembled substrate cleaning apparatus and having ammonia and aqueous ammonia as the replenishing feed fluid. The change in etching rate with time and change in concentration of etching components, namely ammonium fluoride (NH<sub>4</sub>F) and hydrofluoric acid (HF), with time were measured. The measured rates and concentrations were charted with respect to time on the graphs attached as Exhibit A.

3. The results of the experiments discussed above show unexpected differences between using ammonia or aqueous ammonia as feed fluids compared to ammonium fluoride and water. Specifically, because ammonium and aqueous ammonia are very volatile and act as buffers, their usage allows for greatly improved maintenance of constant and stable concentrations within the etching solution composition. Another unexpected result from using ammonium and aqueous ammonium is the ability to maintain much more constant etching rates over time. Use of ammonium fluoride and water do not result in the stated benefits. Instead, use of these fluids results in undesirably varying etching component concentrations and etching rates. As specific evidence of the unexpected results, the first page of graphs in Exhibit A shows the etching rate is much more controlled and constant in the second figure, in which ammonium water or ammonium were used as replenishing liquids, compared to the first figure, in which water or ammonium fluoride were used as replenishing liquids. As additional evidence of the unexpected results, the second attached page of graphs in Exhibit A shows the concentration of ammonium fluoride ( $\text{NH}_4\text{F}$ ) over time is much more controlled and constant in the second figure, in which ammonium water or ammonium were used as replenishing liquids, compared to the first figure, in which water or ammonium fluoride were used as replenishing liquids. Further, there are numerous practical benefits and advantages resulting from these unexpected effects. For instance, when the concentrations in the etching solution are more constant, less frequent replenishing of the substrate cleaning bath is required. Less frequent replenishing results in large conservations of cleaning fluid, waste water treatment agents, energy, and costs. Also, less frequent replenishing results in the diminishment of sludge and waste water produced, which preserves the environment.

4. I hereby declare that the statements made of my own knowledge are true and that all statements made on information or belief are believed to be true. I acknowledge that willful false statements and the like are punishable by fine or imprisonment or both (18 U.S.C. § 1001) and may jeopardize the validity of this application or any patent issuing therefrom.

Date: February 26, 2004

Yasuhito Inagaki  
Yasuhito Inagaki

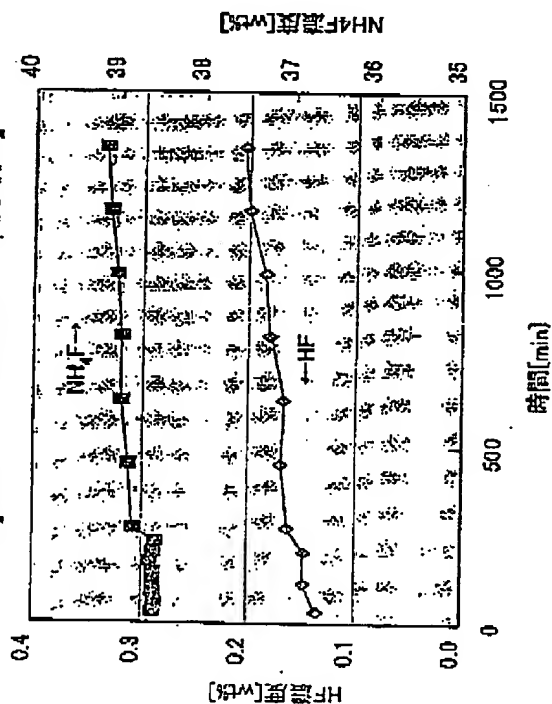
## **EXHIBIT A**

### **Experimental Results**

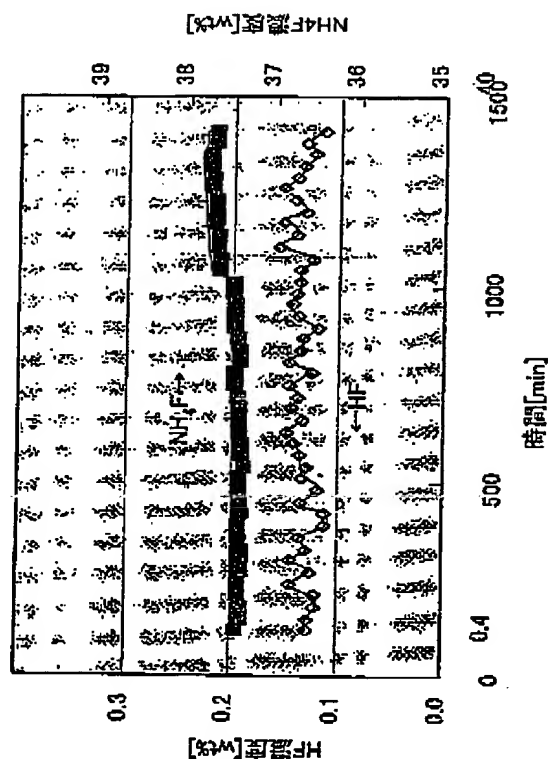
**2 pages**

## Change in concentration of etching components with time

[ after adding replenishing liquid of water /  $\text{NH}_4\text{F}$  ]

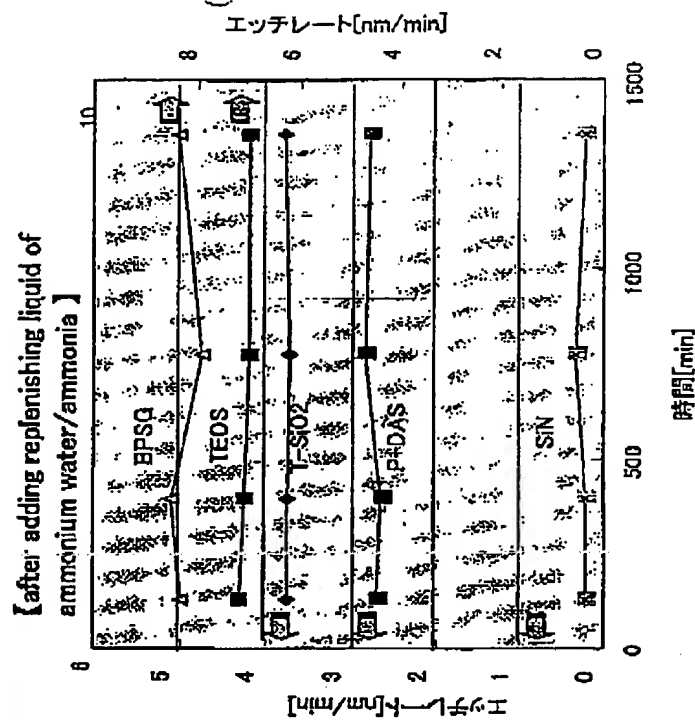
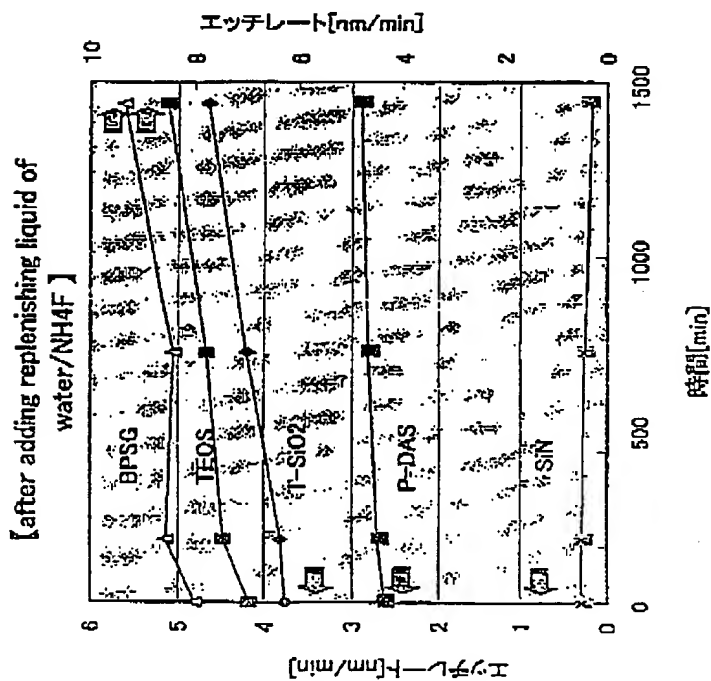


[ after adding replenishing liquid of ammonium water / ammonia ]



Experimental Results, Page 1 of 2

## Change in etching rate with time



Experimental Results, Page 2 of 2